Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
LightSquared Technical Working Group Report	)	IB Docket No. 11-109
LightSquared License Modification Application, IBFS File No. SAT-MOD-20120928-00160-00161, SES-MOD-20121001-00872	)	IB Docket No. 12-340
New LightSquared License Modification Applications IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091	)	IB Docket No. 11-109; IB Docket No. 12-340
Ligado Amendment to License Modification Applications IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091	)	IB Docket No. 11-109

COMMENTS OF DEERE & COMPANY

Deere & Company ("Deere"), by its undersigned counsel and pursuant to Section 1.106(g) of the Commission's Rules, 47 C.F.R. § 1.106(g), hereby submits these comments in support of the many Petitions for Reconsideration[1] seeking modification of the conditions in the Ligado Order[2] to use the 1 dB standard as the interference protection criteria for assessing potential interference to GPS rather than the impracticable "performance-based" metric that was adopted in the FCC's order.

Deere also corrects certain inaccurate statements in the Ligado Order. Deere does not object to the deployment of Ligado's network as long as the company complies with the technical parameters set forth in its 2015 Settlement Agreement, which were incorporated into the FCC order. However, the FCC inaccurately characterized Deere as affirmatively endorsing

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1 *See infra*, n. 5.

2 *LightSquared Technical Working Group Report et al*., Order and Authorization, FCC 20-48 (rel. Apr. 22, 2020) ("Ligado Order").

and supporting the Ligado plan; Deere does not endorse or support Ligado's plan. Deere disagrees with the FCC's characterization of the conditions in the Ligado Order that requires Ligado to provide a greater than 20 MHz "guard band" to protect GPS operations. The spectrum in question cannot reasonably be characterized as a "guard band" given that it is actively used by satellite service providers and that Ligado's adjacent high power terrestrial operations will only further complicate GPS receiver noise filtration issues.

I. Consistent with the Terms of its Settlement Agreement, Deere Neither Objects to Nor Endorses the Deployment of Ligado's Planned Terrestrial Network

At the outset, Deere would like to correct certain erroneous statements present in the Ligado Order. On December 8, 2015, Deere entered into a "Settlement Agreement and Mutual Release" with Ligado.[3] The Ligado Order mischaracterizes the nature of the agreements that Deere and other similarly situated GPS manufacturers reached with Ligado by repeatedly referring to them as "co-existence agreements."[4] Consistent with the terms of the Settlement Agreement, Deere does not object to the deployment of Ligado's network and recognizes that the agreed-upon technical parameters from the Settlement Agreement were duly incorporated into the Ligado Order. However, Deere clarifies that it never entered into a "co-existence agreement" with Ligado. In fact, as a technical matter, some Deere receivers will experience interference. Questions about the level and extent of this interference will remain until information about the Ligado system deployment timing and siting are provided. Nothing in the Settlement Agreement should be misconstrued as an affirmative endorsement of Ligado's planned network; rather, Deere neither supports nor objects to Ligado's license modification applications.

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[3] Letter from Gerard J. Waldron, Counsel to New LightSquared LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 et al. (Dec. 8, 2015), transmitting the "Settlement Agreement and Releases" ("Settlement Agreement").

[4] *See, e.g.*, Ligado Order at ¶ 62 (noting that "The GPS receiver manufacturers have entered into these co-existence agreements and provided their support for Ligado's license modification application as amended, establishing that co-existence is possible and feasible under the technical terms of the agreements.").

II. As is Reflected in the Record in the Views of Numerous Petitioners, the FCC Erred in Rejecting the 1 dB Standard

Deere unequivocally stands with the many petitioners who recognize that the FCC made the incorrect choice in abandoning the established 1 dB standard and instead opting to use its unproven "key performance indicators" ("KPIs") approach in evaluating harmful interference to GPS receivers.[5]

As the GPS industry has previously explained, the 1 dB standard determines whether a new service will cause a 1 dB degradation in a receiver's C/N_0 or a 25 percent increase in the interfering noise affecting GPS receivers.[6] It is widely understood that this standard has a long and well-established history in both international and domestic regulatory proceedings as the preferred method for protecting GPS/GNSS operations from harmful interference. To give but a few examples, the FCC relied upon the 1 dB criterion to develop emission limits to protect GPS receivers in its Ultra-Wide Band and Low-Power Television proceedings, and the ITU has consistently applied an interference to noise ratio of -6 dB (equivalent to a 1 dB rise in the noise

[5] *See* Petition of the Aerospace Industries Association et al. for Reconsideration, IB Docket No. 11-109 et al., at 20 (filed May 29, 2020) (noting that the Commission abandoned the 1 dB standard without explanation "despite overwhelming opposition from GPS manufacturers, the aviation industry, and relevant expert Federal agencies"); Petition of the Lockheed Martin Corporation for Reconsideration at 6-9, IB Docket No. 11-109 et al., at Section II (filed May 22, 2020) (noting that the Commission's cursory dismissal of the ABC Study in a footnote was "hardly demonstrative of analysis sufficient" to abandon the 1 dB standard); Petition of the Airline Pilots Association, International, IB Docket No. 11-109 et al., at 14-15 (filed May 20, 2020) ("Use of a stronger technical standard for interference, such as the 1 dB C/N0 proposed by NTIA and other government and private organizations would provide much more confidence in the continued safety of aviation"); Petition of the National Telecommunications and Information Administration ("NTIA") for Reconsideration, IB Docket No. 11-109 et al., at 11 (filed May 22, 2020) ("the Commission's attempt to impose a new and untested IPC for GPS should not be relied upon until proven — and abandoned if it would not garner general consensus among scientific and engineering professionals"); Petition of Trimble Inc. for Reconsideration, IB Docket No. 11-109 et al., at 20, (filed May 22, 2020) ("By rejecting the 1 dB standard, the Commission was able to simply define away the findings of the multi-year DoT study of adjacent-band interference, as well as prior studies that found that substantial numbers of GPS devices would suffer harmful interference from Ligado's proposed operations.").

[6] *See* Trimble Petition at 18 ("Moreover, as the GPS industry has highlighted, the 1 dB standard measures whether a new service causes a 1 dB degradation in a receiver's C/N0 or a 25 percent increase in the noise floor; in other words, a persistent increase of 25 percent in the interfering noise that affects GPS receivers.").

floor) in various GNSS proceedings.[7]

Furthermore, retention of the 1 dB standard is important for protecting GPS moving forward as the FCC continues to consider new technologies and repurposes spectrum uses. For instance, Unmanned Aerial Vehicles (UAV's) are proliferating, and are being proposed for a number of delivery and reconnaissance applications. The growing density of UAV's has increased the probability of collision between UAV's and other aircraft. A radio based Detect and Avoid ("DAA") system is being proposed to maintain airspace safety. The DAA compatibility study will have to use the 1 dB standard to determine the impact of the DAA waveforms and frequencies on GNSS and other services.

Despite the extensive prior use and important future implications of the 1 dB standard for GPS stakeholders, the FCC instead opted for an unproven and impractical alternative based on KPIs. Worse still, the FCC's sole basis for this unprecedented shift in protection criteria was two Ligado-sponsored tests which focused exclusively on position and timing KPIs without considering the myriad of other functions supported by GPS systems.[8] As Deere has previously explained,[9] no empirical, universal and quantifiable alternative to the 1 dB C/N_0 standard exists for evaluating harmful interference into a GPS/GNSS service. Deere continues to urge the Commission to avoid the obvious pitfalls and shortcomings of attempting to evaluate

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[7] Letter from J. David Grossman, Executive Director, GPS Innovation Alliance, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 and 12-340, at 9-10 (filed Dec. 20, 2019) ("as technologies have proliferated, experts and regulatory bodies have applied the 1 dB standard to govern both out-of-band emissions ("OOBE") and overload interference from services into adjacent bands, including the RNSS band.").

[8] Aerospace Industries Association et al. Petition at 20 ("Despite overwhelming opposition from GPS manufacturers, the aviation industry, and relevant expert Federal agencies who depend on GPS regarding propriety of the 1 dB Standard, the Order inexplicably relied exclusively on the Ligado-sponsored testing, which examined only a limited number of devices and reviewed only two performance indicators: position only in the case of Roberson and Associates ("RAA") and position and timing in the case of the National Advanced Spectrum and Communications Test Network ("NASCTN")").

[9] *See* Reply Comments of Deere & Company at 7-12, IB Docket Nos. 12-340, 11-109, IBFS File Nos. SAT-MOD 201120928-00160; SAT-MOD-20120921-00161; SAT-MOD-20101118-00239; SES-MOD20121001-00872 (filed June 21, 2016) ("Deere June 2016 Reply Comments").

interference into GPS/GNSS service based on end user outputs or metrics (e.g., location accuracy), which are inherently subjective and unreliable in this context. Given the tremendous diversity in GPS/GNSS receiver design and use models, even the broadest, most inclusive test program cannot credibly claim to have harmonized and evaluated end user outputs in a meaningful way against a potentially interfering signal. For example, with respect to location accuracy, a degradation of only a few centimeters may render a high-precision receiver unusable or inoperable, whereas a markedly greater degradation may not impact the end user of a general navigation and location device. Even within a discrete class or sub-class of device (e.g., high precision receivers) there may be varied expectations for location accuracy depending on the end user's application. Moreover, location accuracy for some devices may involve only horizontal position, while other devices may place an emphasis on high accuracy in degraded reception scenarios. Employment of differential correction systems to augment the GNSS signals further complicates the use of position accuracy as a degradation metric.

Due to this diversity in design and use models, any attempt to evaluate location accuracy would need to examine a virtually inexhaustible number of test scenarios to determine if harmful interference occurred from a proposed new terrestrial service, where location accuracy is only one of several important end user outputs. Among other attributes, integrity, continuity and availability are also critical and must be evaluated, and the criticality level of these attributes varies widely depending on the class of device and end user application. Ultimately, Deere views any effort to evaluate harmful interference into GPS/GNSS service based on end user outputs as unlikely to survive rigorous scientific scrutiny.

Many petitioners have correctly observed that the KPI approach is not only unworkable,

but in certain contexts (i.e., aviation) potentially dangerous to human life and safety.[10] NTIA warned that the interference measurement approach adopted in the Ligado Order, if implemented as currently written, "would endanger the reliable functioning of federal GPS devices and associated weaponry and equipment."[11] Similarly, the Aerospace Industries Association et al. observed that the Commission's stated approach "will endanger life and property."[12] As Trimble observed, the Commission set forth a nebulous standard of harmful interference that would use ill-defined KPIs for each type of GPS receiver or associated system.[13] However, the Commission fails to discuss key practical issues about implementation which must be addressed given that there are thousands of distinct use cases for GPS and nearly 900 million receivers in use.[14] Simply put, given the diversity of GPS applications of services and perpetual addition of new services in this domain, the KPI approach is impossible to implement. It also goes without saying that even if one could tailor the nearly limitless applications of GPS to pre-determined KPI categories, this artificial categorization would unduly chill innovation. Furthermore, adoption of the KPI approach runs counter to other critical federal policy objectives. Both Chairman Pai[15], and Congress, by means of the Precision Agriculture Connectivity Act of

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10 *See, e.g.*, Airline Pilots Association Petition at 14 ("The use of a so-called "performance based" metric, where actual degradation of the calculated position must occur before a receiver is considered to have been interfered with, will by its nature be very scenario and receiver dependent. The effect of such interference on the National Airspace System is to reduce safety, but the extent to which it is reduced cannot be determined until after interference is reported. This operational scenario – a wait and see how bad the impact of this experiment will be – is significant cause for concern."); NTIA Petition at 11 (observing that numerous U.S. Senators recently expressed concern about the key performance indicator approach, noting that "[s]etting a standard of not causing interference does not guarantee the performance and safety of their use with statistical certainty.").

11 NTIA Petiton at 16.

12 Aerospace Industries Association et al. Petition at 4.

13 Trimble Petition at 21-22.

14 *Id*.

15 Press Release, FCC, Chairman Pai Announces Working Group for Precision Agriculture Connectivity Task Force, (rel. Mar. 13, 2020) ("The FCC understands the importance of precision agriculture to the nation's economy and wants to encourage its growth across the country.")

2018,[16] have recognized the high priority and important public interest in enabling high-precision agriculture. Abandoning the 1 dB standard and thereby jeopardizing the underlying technological infrastructure for precision agriculture is inconsistent with such goals.

In Deere's view, the FCC erred twice both in failing to consider the infeasibility of the KPI approach, and in accordingly failing to provide an adequate rationale for abandoning the 1 dB standard for the KPI approach. It is critical that the FCC recognize that the question of the appropriate method for measuring interference into GPS systems has implications that go far beyond the confines of the Ligado proceeding. The FCC has abandoned the existing proven method for assessing interference for an unproven and, Deere believes, unworkable approach that will lead to significant uncertainty in the existing and future use of GPS for precision, navigation, and timing., For these reasons, Deere would strongly encourage the Commission to revisit this issue and bring much-needed reassurance to the GPS community by instead basing protections on the widely accepted 1 dB standard.

III. The Commission's Assertion that the Ligado Order Protects GPS Operations with a Greater than 20-Megahertz Guard-Band Is Fundamentally Misleading

The repeated claims in the Ligado Order that the terms of the Order provide for the creation of a "more than 20-Megahertz guard-band"[17] between the planned terrestrial network and GPS operations in RNSS spectrum rest on a mischaracterization of the underlying spectrum in question. While it is true that the Order would confine Ligado's downlink operations to 1526-1536 MHz and the pertinent lower bound of GPS operations is at 1559 MHz, the intervening spectrum is not a vacuum in terms of RF operations. Rather, the entirety of the 1525-1559 frequency range is allocated on a primary basis for operations in the Mobile Satellite Service

[16] Subtitle E of Title XII of Public Law 115 – 334,132 STAT. 4992.

[17] *See* Ligado Order at ¶ 7.

("MSS").[18] Satellite services make shared use of this spectrum today for downlink operations of MSS providers, but now GPS receivers will have to contend with transmissions from a fundamentally different high power terrestrial network deployed on a scale vastly exceeding that of any genuinely *ancillary* terrestrial component. Hence, while the Order presents the modified configuration of Ligado's network as a protection for GPS operations, it should instead be recognized as a further burden compounding existing obligations to coexist with adjacent MSS operations.

Respectfully submitted,

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[18] *See* FCC Online Table of Frequency Allocations at 35, *available at* https://transition.fcc.gov/oet/spectrum/table/fcctable.pdf.

CERTIFICATE OF SERVICE

I, M. Renee Britt, Senior Paralegal of Morgan, Lewis & Bockius LLP hereby certify that the foregoing COMMENTS OF DEERE & COMPANY were served on this 1st day of June 2020, by e-mail, to the following:

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